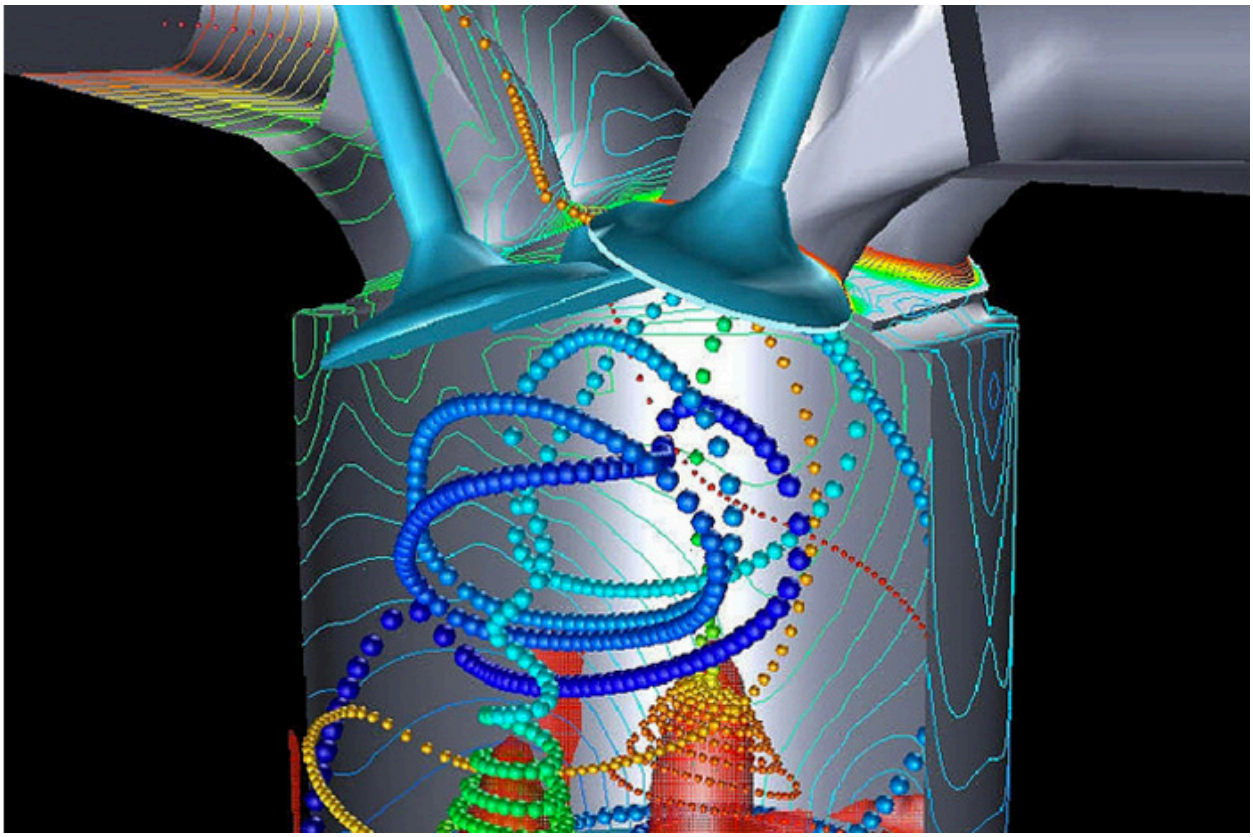
LANL computer model boosts engine efficiency

September 25, 2012



Diesel-powered vehicles on the road are more efficient and cleaner burning thanks in part to a LANL combustion computer model. The KIVA model has been instrumental in helping researchers and manufacturers understand combustion processes, accelerate engine development and improve engine design and efficiency.

Automobile engine fuel economy depends heavily on engine efficiency, which in turn depends on how the engine burns fuel. Fuel economy can be achieved with high pressures and temperatures in the fuel cylinder. But that makes combustion more difficult to control, which can lead to greater emissions and lower engine efficiency.

Before KIVA and similar models, designers optimized combustion by manually tested engines, analyzing the results and then making adjustments. That iterative process is painstakingly slow, costly, and does not lend itself to identifying an optimal engine design.

The 1970s fuel crisis created urgency for greater fuel economy and more efficient energy design and testing. The computational fluid dynamics expertise that Los Alamos National Laboratory has been developing since the Manhattan Project was an ideal starting point for developing the codes that became KIVA.

Today, engine prototyping and testing is still important but KIVA helps speed up the process. One company, Cummins, even used KIVA and other software to go straight from engine simulation to production.

KIVA is now a global mainstay for commercial software development in combustion modeling and commercial engine development with hundreds of active commercial users and 500 executed licenses. The big three American automakers, Cummins, John Deere, multiple national laboratories and NASA all use the technology. It's also a research and teaching tool at many academic institutions including Iowa State University, University of Wisconsin, and Michigan Technological University. More than 500 journal papers have been published using the software.

Continued development of KIVA, funded by the Department of Energy's Energy Efficiency and Renewable Energy Vehicles Technology Program, is addressing greater accuracy in modeling combustion processes, progress toward even more efficient engines, along with increased ease and speed of modeling. KIVA users are applying it to diverse problems including investigation of various fuels, fuel flow in gas turbines for looking at gas dispersion and other engine types.